

SYNTAX ZX80[®]

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Return your white renewal card early for free SYNTAX magazine binder.

TIMEX Sinclair 1000

Timex, the watch company that has always built Sinclair computers, will market and distribute Sinclair-based products in North and Central America and the Caribbean beginning this year. Note the new name--Timex-Sinclair 1000. This computer is a virtual twin to the ZX81, except for an extra 1K RAM under the hood (2K total).

Watch for these other changes:

Price--TS 1000 will sell for \$99.95 assembled. There will be no more kits. 16K RAM packs will go for \$49.95.

Availability--Expect computers, software, and peripherals from Timex to be in greater supply than from Sinclair. According to the agreement with Sinclair, Timex must meet certain production levels (about 3x current level). You will be able to buy computers, etc., at Timex' 100,000 retail outlets, including drug and department stores.

Other Products--Timex just announced availability of two new products for 4th quarter 1982: direct connect modem (\$99.95) and printer (\$99.95). The printer shown at a recent press conference looked identical to Sinclair's UK ZX printer, although we expect the shielding is improved to satisfy the FCC. The modem will allow TS1000 and ZX81 users to access any phone-up data base.

Additionally, Timex plans to offer 25-30 assorted educational and business software packages in July 1982, from \$9.95-\$19.95.

According to Timex Product Manager Bill Skyrme, Timex is very interested in customer support. The TS 1000 will come with a manual for beginning BASIC programmers. Timex will continue Sinclair's 90-day warranty policy. Service will probably be handled through Timex' Little Rock, AR, facility, where watches are repaired in 24 hours. We expect Timex to maintain this level of service to their computer customers.

SYNTAX ERRORS: Walter West reports that Phone Number Generator (Feb.82) gives only 729 combinations as printed. Change line 110 to 110 NEXT Z to get all 2187.

PROGRAM IMPROVEMENTS

William Wentz of Rio Rancho, NM, sent this improvement to Frank O'Hara's Program 1 (from his articles on Numbers Held Inexactly, Mar. & Apr.82). He says that on ZX81s with 3.25K of memory or less, the variable VARS in line 20 is not constant, but keeps moving up as the display file (screen) is used. To improve the program for any memory size, change these lines:

```
15 FOR J=1 TO 5
30 LET I=V+J
50 NEXT J
```

NEW PRODUCT ANNOUNCEMENTS

F/22 Press now offers Darkstar, a program to solve problems for photographers in the dark-room. You need a ZX81 with 16K RAM. The program chooses exposure and processing times for both black and white and color work. Darkstar tape and documentation, \$99.95. For free info, contact Robert Martin, F/22 Press, P.O. Box 141, Leonia, NJ 07605, 201/568-6250.

RKL Systems of Leominster, MA, offers 16K RAM (expandable to 32K), 32K RAM, and single and double joysticks for ZX80/81s. Units are fully assembled and tested. Joysticks come with directions for machine code programs using joystick. Prices: 16K RAM--79.95; 32K RAM--149.95; single joystick--69.95; double--89.95; 16K to 32K upgrade--79.95. Special prices on package deals. RKL Systems, P.O. Box 515, Leominster, MA 01453.

Memotech Corp., Oxford, UK, now sells their \$179.95 64K RAM pack in the US directly and through distributors. It plugs directly

into the computer and runs off the existing power supply. It provides up to 15K of RAM for BASIC programs with 32K left for arrays and variables. Or you can cut back the BASIC and fill up to 45K with arrays. Another 8K can be used for machine code or data without being affected by NEW and RUN commands.

They also plan a 16K RAM pack, high resolution graphics pack, digitising pad, and RS232 and Centronics interface. Memotech Corp., 7550 Westvale Ave., Suite 220, Denver, CO 80227, 303/986-0016.

USERS' GROUPS

Here's this month's list of new ZX users' groups. Send us word of your group and we'll send local users to you. To locate a group in your area, send us a SASE and we'll tell you what we know.--AZ

Sacramento, CA: Contact William Madden, PO Box 8201, Sacramento, CA 95818, 916/444-6780.

North Dakota: Contact K. Allen Ward and Lonnie Misner, 520 Tulane #205, Grand Forks, ND 58201.

St. Paul, MN: Contact Tom Lindquist, 1740 Beechwood Ave., St. Paul, MN 55116.

Indianapolis, IN: Contact Andrew Thomas, 2804 E. 55th Pl., Suite Q, Indianapolis, IN 46220.

Memphis, TN: Contact Jimmie Barker, 3791 Barron Ave., Memphis, TN 38111, 901/327-2158.

Need fast ZX80/81 service? Jim Burliegh of Dover, DE, reports that National Electronics III fixed his partially-assembled ZX81 kit for \$24.95 (2.5 hours work plus shipping). Door-to-door by UPS took 8 days. National Electronics III, 10425 Kingston Pike, Concord, TN 37922, 615/690-8927, Jeff Thompson, manager.

NUMBERS HELD INEXACTLY ON THE ZX81
(Part 3 of Dr. O'Hara's article)

What is the largest integer a ZX81 holds exactly? The manual is wrong in saying that 2^{32} is the largest. The largest is really $2^{127-295}$, ie., this 39-digit number: 170141183420855150474555134919112130560. Surprised?

The manual is trying to say that every integer up to and including 2^{32} --not just $2^{32}-1$ --can be held exactly on the ZX81. Moreover, 2^{32} is the largest integer for which this is true. But every even integer between 2^{32} and 2^{33} , every multiple of 4 between 2^{33} and 2^{34} , and in general, each multiple of 2^n between 2^n and 2^{n+32} , for $n=0, 1, 2, \dots, 94$ can be held exactly. And every multiple of 2^{95} up to and including $2^{127-295}$ can be held exactly as well. $2^{127-295}$ is held as 255,127,255,255,255 and you can't squeeze another bit into that; the one spare is needed for the sign. Because of overflow and another ZX81 oddity, you may have difficulty in getting this number into Program 1 (SYNTAX Mar.& Apr.82). This works:
 $2*(2**126-2**95+2**94)$

But what of printing? $2^{32}+2$ can be printed exactly: PRINT $2**32+2$ (gives 4294967300). Armed with this information, enter: PRINT "42"; $2**32+2-42E8$ This gives 4294967298, an exact result. But 2^{44} (17592186044416) can't be printed by this method, as 175921E8 is not divisible by 2^{12} .

In theory, 2^{43} could be so printed, but a bit is lost in subtraction on a right shift and is not retrieved. The largest power of 2 for which it works is 2^{39} .

PRINT $2**39$ gives 549755810000 and PRINT "5497"; $2**39-5497E8$ gives the exact result 549755813888. Moral: Don't believe everything you read in manuals! Things can be better, as well as worse.

Frank O'Hara, Surbiton, UK

ZX81 SOFTWARE

CUBE

A scientific approach to solving the Cube. This program allows you to set up and move the Cube in any configuration, gives you a choice of displays -- two dimensional, three dimensional and flat -- and remembers every move.

16K \$14.95

THE CHECK BOOK

Get rid of the draw full of old checks and end the monthly hassle of checkbook balancing with THE CHECK BOOK. This personal or business checking account program stores up to 250 transactions on a single program. Over 3600 transactions can be permanently stored on a single cassette. THE CHECK BOOK provides all transaction information and memos and will sort by date, latest transactions or alphabetically.

16K \$14.95

BACKGAMMON

This classic game of skill and luck has been transformed into an exciting ZX81 game using fast and efficient machine code and detailed graphics. Backgammon has a choice of four levels of skill and features screen displayed rolling dice and doubling cube.

16K \$14.95

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Rule your own country on a small asteroid in our galaxy. You are provided with secret reports of resources like population figures, stockpiled arms and rations and must utilize your Breeders, Farmers, Workers and Soldiers effectively. If you do you may take over the entire asteroid. If you don't you'll be faced with insurrection. Play against the computer or with up to four players.

16K \$14.95

VU-CALC

Turn your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for such diverse applications as financial analysis, budget sheets and projections. Using a choice of grids and formulas you can quickly and easily set up an entire business or household financial management program.

16K \$19.95

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SINCLAIR UK UNVEILS NEW COMPUTER

After much speculation about Clive Sinclair's "ZX82," few were prepared for his latest computer, announced in London in late April. Not the ZX82, but the **SPECTRUM**. Besides the new machine, Sinclair announced a reported 100K Micro-drive (3" floppy) for the end of 1982. They dropped their UK 16K RAM price by £20, but raised the UK printer price to £59.95. Sinclair US won't know if their RAM prices will drop until late May.

The 8x5x1" Spectrum machine is memory-mapped and comes with 16K ROM and 16K or 48K RAM on board (16K is upgradeable to 48K with an internal expansion board). It uses a Z80A processor at 3.5 MHz. No built-in flat screen TV yet. The new computer offers 8 foreground and 8 background colors and 10 octaves of sound through an internal loudspeaker. The color display is also memory-mapped and gives normal or extra brightness and flashing or steady mode.

Technically, the new machine is not incompatible with ZX81s, but Spectrum uses a different, faster (1500 baud) cassette interface, so you cannot directly load ZX81 tapes. According to Sinclair, "ZX81 programs may be typed into the Spectrum with minor changes." The Spectrum will work with the ZX printer, but not with Sinclair's 16K RAM pack. But it includes an RS232 interface, so hooking up other printers should be possible. Also, Sinclair said Spectrum "may be rendered teletext compatible."

The ZX81's 8K ROM is a subset of the new 16K ROM, so the 16K ROM includes all features of the 8K ROM, plus up to 52 user-defined functions. Single keys control all BASIC commands and functions, 16 graphics characters, 20 color codes and 21 user-definable graphics characters. The Spectrum also has a full-size 40 moving-key ASCII calculator-type keyboard with auto-

repeat, and full upper/lower case.

SLOW and FAST are no more; the Spectrum operates at the FAST mode speed, but with a steady display.

It also has a VERIFY feature, enabling you to check complete storage of data and MERGE, which combines programs in memory with those on cassette. Other new features include multistatement lines, READ-DATA-RESTORE functions, and a real-time clock.

Great, but what about the important details? At first, Sinclair will sell the Spectrum by mail order in the UK only. Price: £125 for 16K RAM and £175 for 48K RAM. The optional 16 to 48K RAM upgrade will be £60. Don't expect to see the Spectrum machine in North America until around December 1982, when Timex will presumably handle it. US prices are not set, but at press time the British pound was worth about \$1.70 US.

Sinclair also announced 26 new ZX81 software packages developed by ICL and Psion in England and available in the UK in May. The packages include record keeping, games, and educational tapes. Most use 16K RAM. Expect these to be available in the US in late May.

LOGIC CHIP FAILURE SYMPTOMS

Milton Halpern of Plainview, NY, deduced that his ZX81 logic chip (IC1) had failed from the keyboard line and diode matrix.

Here's a chart of the symptoms:

KBD	DIODE NUMBER							
	1	2	3	4	5	6	7	8
0	-	-	-	-	-	-	-	-
1	2	W	9	S	O	Z	L	.
2	3	E	8	D	I	X	K	M
3	-	-	-	-	-	-	-	-
4	5	R	6	G	Y	V	H	B

Chart shows result of jumper contact from KBD line to diode number. "-" means oscillation or blank screen. His K cursor was normal at the start. He got a new logic chip from Sinclair and now the ZX81 works fine.

MEMORY DECODING ABOVE 16K

Sinclair made the ZX81 RAM easy to decode up to 16K, but you may want to add memory beyond this point. To add more than 16K memory to your ZX80/81, you must do more than just:

$\overline{A13} \text{ AND } \overline{A14} \text{ AND } \overline{A15} = \overline{\text{RAM CS}}$

You'll also need to account for the behavior of the display file.

If you decode your 1st 16K block with $A14=1$ and $A15=0$, the system crashes. ZX computers need the display file active for display, and the 8K ROM makes $A15$ high during display. You can use the relation:

$\overline{A14} \text{ AND } (\overline{M1} \text{ OR } \overline{A15}) = \overline{\text{RAM CS}} \quad 0\text{-}16\text{K}$

To get the second 16K block use:

$\overline{A14} \text{ AND } \overline{A15} = \overline{\text{RAM CS}} \quad 16\text{-}32\text{K}$

Get the 3rd 16K block using:

$\overline{A14} \text{ AND } \overline{A15} \text{ AND } \overline{M1} = \overline{\text{RAM CS}} \quad 32\text{-}48\text{K}$

Sinclair RAMs lack this decoding; you must add it to stack 16K modules.

Use of high-memory sites is limited by the 8K ROM. You can't run Z80 machine language routines here, nor extend the display file past 32768. Store variables and arrays in these high locations.

To find the end of the display file,

PRINT PEEK 16400+256*PEEK 16401.
With the extended memory, you must POKE 16388,255 & POKE 16389,255 & NEW, after you power up, but before you load any program. (The ZX81 only checks memory addresses up to 32768, and sets RAMTOP there when you power up.) If you poke RAMTOP too high, your computer will set it correctly after the NEW command.

John L. Oliger
Indianapolis, IN

BANI-TECH Software of the Month Club

Get the most from your ZX81 with 16K, use it to its full potential, while building an impressive inventory of software. Receive twelve listed programs—one a month. Programs like Income Tax Recording, Auto Maintenance, Household Expenses, Price of Gold Forecasting, Diet Planning, Scrooge's Christmas Gift and Card List and many, many more for the incredibly low price of just \$19.95 per year. Save your valuable time and get down to basics!

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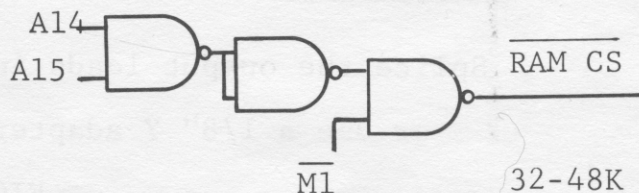
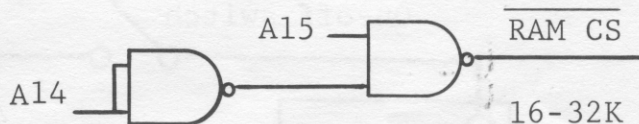
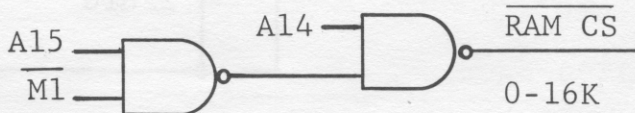
Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

All Gates--74LS00



PROBLEM-SOLVING CIRCUITS

If your power line voltage is 120V or higher and you use a 16K RAM, heat build-up in the ZX81 is a problem. Reducing the power supply voltage to the unit from about 10 VDC to 8V with a pre-regulator will lower ZX81 regulator dissipation by 40%. Voltage above 8V is mostly ripple and only heats up the ZX81.

My pre-regulator was built from junk parts, but commercially available units should work as well. The circuit in Fig. 1 is adapted from National Semiconductor Application notes. Use a suitable heat sink with the LM 340-8.

If you're troubled by line interruptions, a simple circuit of 4 or 5 silicon diodes in series with a 12V car or boat battery will take over on line failure and prevent program loss. Any silicon diode rated at 1A or above works OK. Since the forward voltage varies, try 4 or 5 in series to get 8-8.5V into the ZX81 while operating. A small trickle charger will keep the battery charged, or use a normal charger occasionally.

Or you could operate only from the battery and not use the plug-in ZX81 supply. The 9" portable TV I use as a monitor also operates directly from 12VDC.

Ed Battenhoff, Grand Rapids, MN

Radio Shack #274-297
1/8" Pin Jack

Radio Shack #274-286
1/8" Pin Plug

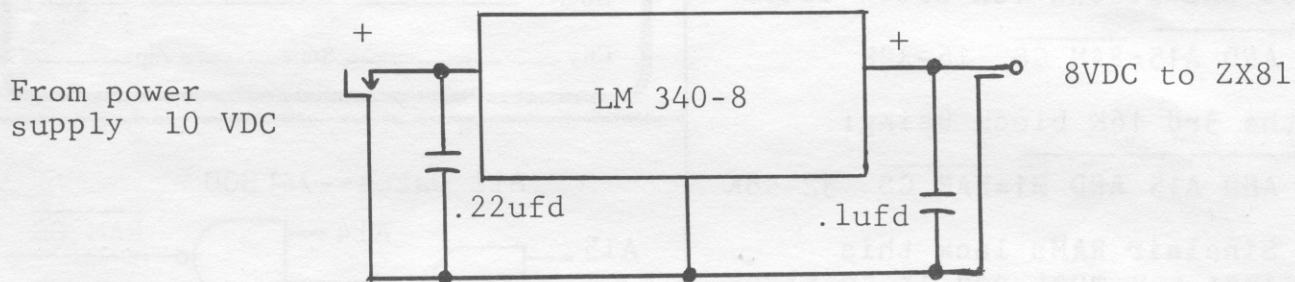
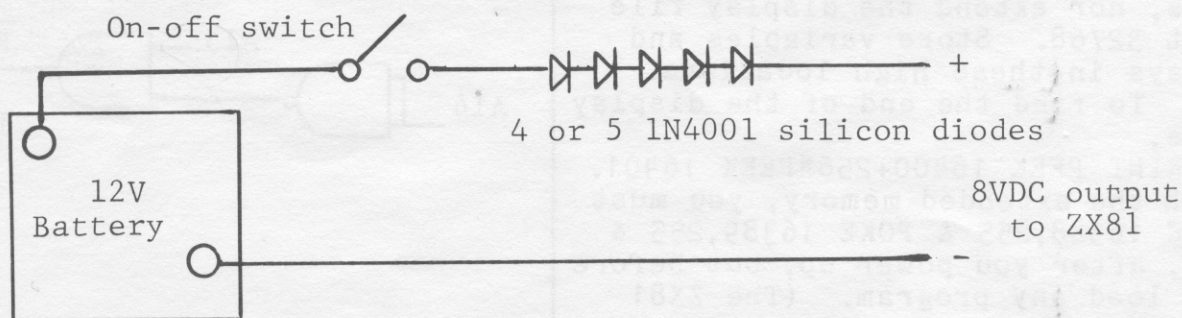


FIGURE 1



Splice the output leads into the ZX81 power supply leads or use a 1/8" Y adapter.

FIGURE 2

MEMOPAK 64k

\$179.95

Memopak 16k has just become available for a price of only \$79.95

IF 00 *FOR 800
PRINT - (RU)/IB*(GT)
LET TX - GOTD 120
DATA D.L.S

MEMOPAK 64k

ZX81

Can you improve excellence?

We can. By adding our Memotech Memopak to the excellence of the ZX81 we have achieved perfection.

The growth of interest in computer use caused by the introduction of the Sinclair ZX81 has made new and exciting demands on the ingenuity of electronic engineers. At Memotech we have focused our attention on the design of inexpensive, reliable memory extensions.

The Memopak is a 64K RAM pack which extends the memory of the ZX81 by a further 56K. The new memory extensions are designed to be within the price range expected by Sinclair users. It plugs directly into the back of the ZX81 and does not inhibit the use of the printer or other add-on boards. There is no need for an additional power supply or leads.

Increase your memory.

The Memopak together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts such basic commands as 10 DIM A(9000).

MEMOTECH

Memotech Corp.
7550 W. Yale Ave.
Suite 220
Denver Co. 80227
Ph. (303) 986-0016

0-8K . . . Sinclair ZX81 ROM

8-16K . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programs, and can be used to run assembly language routines.

16-32K . . . This area can be used for basic programs and assembly language routines.

32-64K . . . 32K of RAM memory for basic variables and large arrays.

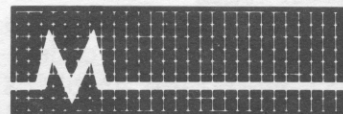
With the Memopak extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

Free service on your Memopak.

Within the first 90 days, should anything go wrong with your Memopak return it to us and we will fix or replace it free of charge.

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☐ Check

☐ Visa ☐ MC

Exp. _____

Act. No. _____

Signature _____

Name _____

Street _____

City _____

State _____

Zip _____

† U.S. Dollars

	Price †	Qty.	Amount
Memopak 64k RAM	\$ 179.95		
Memopak 16k RAM	\$ 79.95		
Shipping and Handling	\$ 4.95		\$ 4.95
		Total	

BEGINNER'S BASIC--INKEY\$ FUNCTION

The INKEY\$ function, though more obscure than commands like SAVE and RUN, is simple to use and adds a nice touch to your programs.

INKEY\$ plus a PAUSE command causes your ZX81 to wait, watching the keyboard until the user presses a key. That key is then accepted as input and the program proceeds.

Substitute INKEY\$ for an INPUT line. Say your program asks the user to choose between 3 options. Line 100 might read:

```
100 PRINT "CHOOSE THE MONTH YOU WISH: 1. JAN 2. FEB 3. MAR"
```

You could follow this with

```
110 INPUT X
```

```
120 IF X=1 THEN GOTO...
```

```
130 IF X=2 THEN GOTO... etc.
```

The user must press his desired number, then ENTER or NEWLINE.

When the input is a single digit, you can use the INKEY\$ function instead:

```
110 IF INKEY$="1" THEN GOTO...
```

```
120 IF INKEY$="2" THEN GOTO...etc.
Note that you must include " " marks in the INKEY$ statement.
```

With this kind of input, the user just presses his choice and the ZX81 carries on. Reducing the time and steps for input makes the program simpler for the user.

You must also include a PAUSE statement **BEFORE** the INKEY\$ lines. The PAUSE makes the computer wait. Add a line like:

```
105 PAUSE 500
```

The ZX81 waits about 10 seconds for input. Vary this time by changing the number after the PAUSE.

Experiment to find a good time for your program. If you have an old 8K ROM, add a POKE 16437,255 line after the PAUSE. (To check your ROM, see p.19.)

Keep this in mind: INKEY\$ doesn't wait, so the user cannot correct a mistake using the RUBOUT key. Use INKEY\$ for input when you want a fast-moving program and your user has little chance of error.

ZX81 OWNERS with 16K RAM!
IT'S READY---ARE YOU?



\$14.95 +
2.50 S&H

If so, you get:

- *24-row/full-screen displays
- *Nearly 2K of machine code for FAST real-time graphics
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- *9-each fuel and skill levels that are interlocked for more "reality"
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- *An enemy data generator imbedded in the run as part of the "action"
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- *In-depth booklet explaining both the "game" and the program
- *Shipped on a certified cassette 1 copy each side



16K Programs for either ZX80-8K or ZX81

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PUTTING FORTH ON ZX80/81S

Although BASIC is the most common language for programming microcomputers, it is not the only one. Your ZX80 or 81 can learn FORTH, another high level language. (For an intro to FORTH, check out Byte Aug. 80.) FORTH has several advantages over other languages in certain applications, particularly in computers as controllers.

Artic Computing announced that they were developing FORTH on an EPROM (erasable programmable read only memory) for the ZX81, to be available in April. No word yet on their success. The package, 2 4K EPROMs on a board with users manual, sells for £60, or about \$102 US. For info, contact Richard Turner, Artic Computing, 396 James Reckitt Ave, Hull, England HU8 0JA.

Richard Holmes of Batavia, IL, has partially implemented FORTH on his ZX80 with 8K ROM and 16K RAM. He reports:

My starting point was Threaded Interpretive Language by R.G. Loeliger (\$18.95 from Byte Books, 70 Main St., Peterborough, NH). This book contains most of the assembly code needed to implement FORTH on a Z80-based computer. It certainly makes the job easier, as long as you watch for the occasional typo. The worst problem with the book is that Loeliger's division routines are faulty.

The book doesn't give routines to make FORTH work with the ZX80/81 configuration. I had to write 3 main machine-dependent routines--\$ECHO (writes a character to the screen), \$KEY (displays the screen and gets keyboard input) and BASIC (returns control to the 8K ROM).

Some requirements: on return from a USR call, registers IY and I must contain 4000h and 1Eh. Of course, SP must also be undisturbed. HL' must also be preserved. So on startup, FORTH must save SP and HL'. Then when the BASIC routine is called, it

must restore SP and HL', load 4000h into IY (my FORTH code doesn't mess with I, so no need to reset it), and do a RET to get back to the ROM. My version also calls a routine that saves all the registers in a block of RAM locations you can PEEK. This helps enormously when debugging.

\$ECHO and \$KEY are based around calls to ROM routines. \$ECHO sets up a RST 10 call, which takes care of writing to the screen. You have to load 4000h into IY first. \$KEY calls routines at 0229h (displays screen), 0F48 (cleans up keyboard handling) and 07BD (decodes the keyboard). Again, 4000h must be loaded into IY; also IX must be preserved before these calls as the ROM doesn't preserve it.

One other problem concerns character sets. FORTH is based around the ASCII (American Standard Code for Information Interchange) set which includes characters not in the ZX81 set. I defined an ASCII to ZX81 "mapping"; I replace needed ASCII characters with inverse ZX81 characters as follows:

ASCII	ZX81	ASCII	ZX81
a-z	A-Z	!	.
#	=	%	f
&	+	'	"
@	?	[,]	(,)
\	/	^	*
_	-	{,}	<,>
~	;		

Rich added that he would discuss putting FORTH on a ZX80/81 with anyone who's interested. Send him a SASE and \$.50 to cover reproduction of his materials. Richard S. Holmes, 1303 E. Wilson Apt. 4, Batavia, IL 60510.

Howard Gladstone of Gladstone Electronic Distributors called to say they remastered all their tapes. Our review of their ZXAS and ZXDB programs reported trouble loading these tapes. This problem should no longer exist for tapes shipped after mid-April 1982.

DEAR EDITOR

You can use your Sinclair computer to enjoy interactive communications (games, program and data transmitting/receiving) via the phone lines by building the very low-cost "Mickey Modem" as described in the Nov. 1978 issue of Kilobaud. Restrictions: both parties must have a Mickey Modem and use the same ROM; it only works on local phone lines (no long distance); and you must know your receiver's RAM capacity (you can't transmit 16K of program into 1K of RAM space...but the receiver's modem could be hooked up to his recorder and the program saved.).

Another goodie is the "Computer Music Box Peripheral" article in Popular Electronics, April 1978. It shows how to build a low-cost, 12-tone, 4-octave music generator that can be tied to an output port such as shown in SYNTAX, Jan.81 p.7.

Let's dig out those cheapie projects from old magazines we can easily adapt to OUR computers!

Patrick Kelly, Los Angeles, CA

We haven't tried these projects.--AZ

Banta Software (RD #7, Bethlehem, PA 18015) has 3 very good programs on tape for \$3.95--Football, Super Monzzer, and Murder in the RAM. All are 16K, run well and interesting to play. Banta will make the tapes good if they don't run. I had some trouble with a tape and they worked with me to get it running. I am happy with these programs--for \$3.95 you can't go wrong. I will not recommend the monopoly game.

Laverne Hoffman, Canby, OR

With the 16K RAM, the new power pack is around 13.5-14V (depending on line voltage). The small electrolytic capacitor

adjacent to the 5V regulator is rated at only 16V. After an hour or so of operation, a small "worm" crept up the TV display, typical of poor DC filtration. I changed to a 470 mF at 25V for additional filtration and a margin of safety.

My unit was reinstalled in a custom case with aluminum front and rear panels. I simply unbolted the 5V regulator from the PC board and turned the heat sink around and rebolted it to the rear chassis panel. It runs cool as a cucumber. It was heating the the adjacent ICs after 15-20 minutes and causing the system to crash. Taking it off the PC board corrected this.

Glen DeLong, Moneta, VA

I would like to add a reverse video switch and a video monitor to my ZX81 as I did on my ZX80. What modifications and connections do I need to make?

Ronald Swager, Springfield, IL

Unfortunately, you cannot simply switch a ZX81 to reverse video as you can a ZX80 (just a jumper on the board). We do not know how to reverse the video.

To hook up a video monitor, pick up the video at pin 16 of IC1. Pick up a ground somewhere (like the modulator case). Connect these to the composite video input of any monitor with greater than 1000 Ohms input impedance. If the impedance is 50-75 Ohms, add a buffer. Use a source-follower or an emitter-follower.--K0

I would like to praise the repair department at Sinclair for the fast, efficient and neat job they did for me and my bungling. Twice I damaged my ZX81 and/or RAM, returned them with payment for repair. They came back with remarkable speed (2 weeks the first time) and no additional bill. I was amazed. Sinclair also replaced

a tape I could not get to load, at no charge. I thank them from the bottom of my RAM.

Also, a supply house called Poly-Paks sells surplus computer goods. Their parts are reasonably priced and of good quality. They tell you exactly what you're ordering, such as "ICs 100% guaranteed, untested." They are at 16-18 Del Carmine St., Wakefield, MA 01880.

John Tiffin, Evanston, IL

It's good to hear that not everyone has to wait interminably for shipments from Sinclair. If you're waiting for a repair from Micro-sync, see the story on p.14.--AZ

The Radio Shack 276-1558 40-pin card edge connector can be used with the ZX80/81. The connector also requires the Radio Shack 40-wire flat cable. This leaves 4 pins that must be hardwired to any peripheral devices. The two ends

of the connector must be partially removed for the ZX81. I added home brew memory using this technique for connecting to the ZX80/81.

Hans Roensch

Editor's note: Having been accused of running a catalog of things impossible to procure, I'm happy to report that The Fast One (data management program from England), reviewed in Apr.82, is available in the US from Mindware Inc. For a free catalog, contact Mindware, 70 Boston Post Rd., Wayland, MA 01778, 617/358-7175.--AZ

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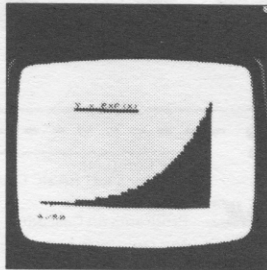
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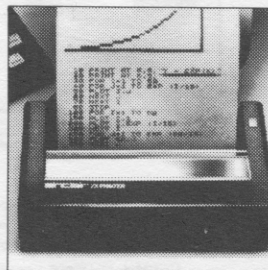
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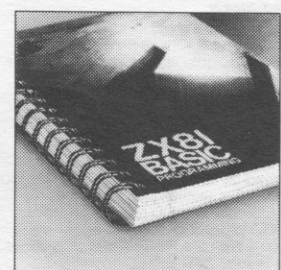
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2K CONVERSION WITH 6116S

While assembling my ZX81, I noticed the provision for adding a 2Kx8 RAM. While soldering sockets to the PC board, I included both the 18-pin sockets for the 2114s supplied with the kit, and a 28-pin socket for the alternative memory. (The middle plastic portion of the 28-pin socket must be cut out so it fits over and around one of the 18-pin sockets.)

I ordered a 6116 2K memory by mail. When it arrived, I simply replaced the two 2114s with the 6116. The conversion was simple and works fine. I can now fill the screen with graphics!

My only problem was assuming that the position of jumper J1 on the PC board corresponded with that shown on the schematic. It didn't. When you install the jumper, make sure to use the component I.D.s printed on the PCB front.

Insert the 24-pin DIP with the proper orientation and in the lower 24 pins of the 28-pin socket (similar to the 8K ROM).

I used the Hitachi HM6116P-3 2Kx8 static CMOS RAM from Jameco Electronics (1355 Shoreway Rd., Belmont, CA 94002, 914/592-8097, hrs Mon-Sat 8-5 PST). Actually, their catalog lists the device as P-4, but I received a P-3 and it works great. Cost: \$14.95 plus \$1 postage, \$1.50 insurance (\$2 each postage and insurance for foreign orders), plus 6% tax (CA only). A data sheet is \$.25 extra.

I'll use the 2114s for another project, but have toyed with the idea of a 3K conversion. This would involve stacking the 6116 on two sockets to put it above one of the 2114s. Then some PCB traces would have to be cut and two RAM CS signals created. My prototype requires only an additional 74LS00 to generate them from the existing RAM CS and A11.

Paul J. Brogger, Tumwater, WA

MICROSYNC SPEAKS

Yes, Virginia, there is a Microsync. SYNTAX arranged an exclusive, secret interview with Bob Allen, Service Manager.

Microsync exists to service Sinclair computer equipment. Now, about 12 people repair up to 100 machines daily. Most are kits, although less than 1/5 of kit-builders need service assistance.

Many readers ask if ULA (IC1) chips fail more often than others. Bob Allen tells us all chips get replaced with equal frequency in both kit and factory-built units. ULAs do fail more often if installed backward. Although LOAD/SAVE problems can result from ULA failure, Bob says they usually have some other cause.

From experience to date, Bob feels the maintenance pricing accurately reflects the reliability of Sinclair computers.

Microsync's goal is to receive, repair, test and ship most machines in 4 working days. During this startup phase, Bob says delays do reach 3-4 weeks. Just before press time, Bob told us they were servicing items that arrived 5 days earlier.

When your machine arrives, Microsync date-stamps it immediately. Unless the computer was previously serviced unsatisfactorily by Microsync, your computer moves to service in this date order.

At the service area, Microsync dates the order and begins repairs. When done, each repair goes through a QC test by the lead technician.

Next the machine moves to an outgoing area where operators key administrative data into the computer system. Within 24 hours, the shipping papers are printed and the machine entered for UPS shipping.

This is basically a first-in, first-out system and locating your unit prior to completion requires looking through the boxes. Bob offers this advice when you must

check the status of a repair: Use EXACTLY the same name, include your ZIP code, tell EXACTLY when you sent your unit, whether you used parcel post or UPS, and if your unit is a kit or factory-built.

Bob also points out that Microsync will need 3 days to get your reply in the mail to you.

SYNTAX offers additional tips:

- Photocopy the front of the box before you send it. If you inquire, send the photocopy with your letter.
- Make a packing slip for the package you send, and keep a copy to send if you must inquire.
- Send your computer by UPS and insure it. Use UPS Blue Label for faster shipping (2 days).

Bob says common shipping problems result from using flimsy boxes or failing to write your name on the box as well as the wrapping paper. He suggests you use the Sinclair box if possible. Further, shipping to Sinclair in Nashua gives you no advantage.

Only computers with damaged boards are returned by Microsync as unrepairable, according to Bob.

About 1% of machines come back to Microsync as not properly repaired. Bob suggests you return the machine in their box, making it clear that this unit has been in before. Many returns are "no problem found" cases where the customer omitted the power supply and the power supply is the problem.

Power supply problems can cause a number of symptoms, including LOAD/SAVE problems with the 16k RAM attached, left-to-right bars that slowly rotate on the screen, and others. If you have access to a regulated power supply with plenty of current capability and low ripple, substitute it and see if it cures your problem. If you test the power supply yourself, check for increased ripple as well as for proper voltage.

Bob Allen says: "If it's under warranty and works except with the

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RAM, send ALL the pieces."

If you installed an R-PAK wrong in your kit, SAVE THE BOARD AND SACRIFICE THE R-PAK. Don't attempt to remove multiple-lead components without de-soldering tools. Solder-wick won't suffice.

SYNTAX asked Bob what causes delays in service. He replied: "The worst thing is money separate from the unit." He explained that this puts the unit in a holding area, generates a letter to the sender, and may require a search of other correspondence to locate the payment. All of this is labor-intensive and time-consuming.

LOAD/SAVE problems and RAM problems take more diagnostic time. Also, machines with no problem found get extra testing to avoid returning defective machines and annoying customers. Machines requiring estimates also suffer delays for correspondence. Kits with "white screen syndrome" also take longer to diagnose.

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BEGINNERS' ML--REGISTER TO REGISTER (Number 5 in a series)

There are more than 100 1-byte instructions for data manipulation between single registers. These are grouped as "LD r,r"; "ADD r,r"; "SUB r" (from A); logical operations (AND r, OR r, and XOR r); and "CP r" (comparisons to A). Here we'll look at loading, adding and subtracting.

LD r,r is the general instruction for data transfers between single registers. That means that values must be less than 256, because no single register can hold more than 8 bits, or a value of 255. Register pairs are just that--two 8-bit registers.

Before you can transfer data with an instruction such as LD C,E (load data in E into C), the E register must have data in it. In practice, all registers have data in them at all times, but rarely the data you want. So you must

load the "source" register (E in our example) with data before moving it to the "destination" register (C in our example).

Adding and subtracting single registers are similar in that all operations are between the A register (Accumulator) and the other single registers (B,C,D,E,H, or L) or the HL register pair. (ADCs and SBCs are identical to ADDs and SUBs except that they include the Carry bit in the Flags register.)

For example, let's load B with 132, C with 45, and D with 36. Then we'll add B and C and subtract D twice:

REM ADD. DECIMAL=MNEMONIC COMMENT

xx1	6	LD B,n	
xx2	132	(data)	
xx3	14	LD C,n	
xx4	45	(data)	
xx5	22	LD D,n	
xx6	36	(data)	
xx7	120	LD A,B	;B to A (A=132)
xx8	129	ADD A,C	;C+A=177 (A=177)
xx9	146	SUB D	;A-D=141 (A=141)
x10	146	SUB D	;A-D=105 (A=105)

REM ADD lists relative addresses. You can find the decimal codes for instructions in your 8K ROM or ZX81 manual, Appendix A (the character set). The first and third columns list decimal code and corresponding Z80 mnemonic. These codes also serve as character codes in BASIC. You can find explanations for instructions in assembly language manuals such as Zilog's Z-80 Assembly Language Programming Manual.

After "running," A will contain 105 while B,C and D will all contain their "loaded" values. Except for the A and Flags registers, all registers keep their data intact until specifically altered.

Next month: Exchanging Registers

Jon Bobst, Zeta Software, P.O. Box 3522, Greenville, SC 29608-3522

ZX81 INTRO

Here is a little subroutine I use at the beginning of user-friendly programs. Just RUN to start or call it from within your program by GOTO 60 or GOSUB 60. If you use GOSUB 60, change line 270 to RETURN and delete 999. To stop execution in midstream, press BREAK.

This routine uses just about exactly 1K RAM.

A. Kohlenberg, Fremont, OH

```

60 PRINT AT 10,5;"***HI I AM Z
X81***"
65 PAUSE 100
70 PRINT
80 PRINT "I AM A HOME PERSONAL
COMPUTER"
85 PAUSE 150
90 PRINT
100 PRINT "I CAN DO MANY THINGS
AND", "THE BEST IS***"
105 PAUSE 150
110 CLS
120 PRINT
130 PRINT "I NEVE MAKE MISTAKE
S"
135 PAUSE 100
140 PRINT AT 2,7;"UHOOPS"
145 PAUSE 100
150 FOR Y=25 TO 7 STEP -1
160 PRINT AT 2,Y;"B"
170 PRINT AT 2,Y;" "
180 NEXT Y
190 PRINT AT 1,6;"B"
200 FOR A=18 TO 1 STEP -1
210 PRINT AT A,6;"R"
220 PRINT AT A,6;" "
230 NEXT A
240 PRINT AT 1,6;"R"
250 PRINT AT 10,8;"WELL, ALMOST
NEVER"
260 PAUSE 150
270 PRINT AT 11,15;"BYE"
999 STOP
SYNTACTIC SUM: 33973, 8K

```

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BYTESAVERS HINT--8K

If you are using a PRINT after a line number simply to add an empty line, use two commas instead. Often empty lines are useful to clean up a screen display. These two programs display the same spacing--the second saves you four bytes:

Program 1

```

10 INPUT A
20 PRINT A
25 PRINT
30 INPUT B
40 PRINT B (bytes used=34)

```

Program 2

```

10 INPUT A
20 PRINT A
30 INPUT B
40 PRINT ,,B (bytes used=30)

```

Each substitution of commas for blank PRINT lines saves four bytes.

Dave Hallas, Kansas City, MO

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IC INVENTORY--4K/2K

Some hobbyists have trouble keeping track of parts. This program, written for the CD4000 series of ICs and using the 4K ZX80 ROM and at least 2K RAM, can be adapted for any series of things following consecutive numbers. It is beneficial to keep two lists for each series--one of those in stock and one of those used in circuits for emergency substitutions.

The first part of this program is also useful for setting aside memory for machine code routines.

Enter line 1:

```
1 REM 480 BYTES FOR DATA 0123
456789012345678901234567890
Then type EDIT, RUBOUT, 2, NEWLINE.
This duplicates line 1 as line 2 as
saves lengthy typing. Repeat
procedure for line 3.
```

Next POKE out the newline characters at the ends of lines 1&2, combining all three into one long REM statement for the data:

```
POKE 16477,61
```

```
POKE 16531,61
```

Then repeat the duplicating procedure:

```
EDIT, RUBOUT, 2, NEWLINE
```

```
EDIT, RUBOUT, 3, NEWLINE
```

Set the memory behind the first REM to zeros:

```
10 LET A=16426
```

```
20 FOR B=0 TO 480
```

```
25 POKE A+B,0
```

```
30 NEXT B
```

RUN

This leaves 1 REM on the screen and about 2/3 blank, with 90 above the E in line 10. Line 1 now has 482 data spaces available if nothing larger than 255 is entered. Do not enter quantities greater than 255. Each quantity is held in 1 byte, with a 255 maximum.

Now enter the following program. Note that line 25 is changed. After pressing RUN, the screen takes at least 5 seconds to display.

Gyro Burns, Athens, OH

```
10 LET A=16426
15 PRINT,"CURRENT LIST"
20 FOR B=0 TO 480
25 IF PEEK(A+B)>0 THEN GO SUB
300
27 IF PEEK(A+B)>0 THEN PRINT,
30 NEXT B
40 PRINT
50 PRINT "FOR CMOS IC S"
60 PRINT "INPUT THE NUMBERS A
FTER CD4--"
70 INPUT B
80 IF B>480 THEN PRINT "OVERR
ANGE"
85 PRINT
90 IF B>480 THEN GO TO 60
100 CLS
110 GO SUB 300
130 PRINT " IN STOCK"
140 PRINT "LIST OR CHANGE? L/C"
150 INPUT C$
155 CLS
160 IF C$="" THEN GO TO 45
165 IF C$="L" THEN GO TO 10
170 PRINT "TO WHAT?"
180 INPUT D
190 POKE (A+B),D
195 GO SUB 300
197 PRINT
200 GO TO 45
300 PRINT "CD4";
305 IF B<100 THEN PRINT "0";
310 IF B<10 THEN PRINT "0";
320 PRINT B,
330 PRINT PEEK(A+B);
350 RETURN
390 REM CMOS IC LIST 5/1/82
Syntactic Sum: -30692, 4K
```

To check that your 16K RAM pack is working OK on your ZX81, follow these steps:
Pull the power jack and plug it back in to clear the machine.
Type in the immediate mode (with no line number):
PRINT PEEK 16388+256*PEEK 16389
Press ENTER or NEWLINE.
If your 16K RAM is OK, the answer on the screen is 32768. Try it without the RAM attached. With just the internal 1K RAM, the answer is 17408. This routine checks to see where the top of RAM is and reports the highest address.

SOFTWARE REVIEW--8K/1K SLOT MACHINE

Here's another free sample software review--a program directly from New England Software's tape. Try it out and see for yourself.

Part of a package available for \$10 on tape from the address below, Slot Machine runs in 1K, no small feat for a game with its features. The display could be more elaborate, but only at tremendous memory expense. If you have just 1K on your 8K machine, you'll be surprised at what it can do.--AZ

This program simulates a dollar slot machine. RUN the program to start; to exit enter a double letter such as ZZ instead of a bet. Enter your bet each time. The computer displays each window in succession in SLOW. Six different symbols are used. Payoffs are:

■--2 to 1
■■--5 to 1

3 of a kind--20 to 1

Rather than giving you money (who gives away money these days?) the computer starts you at \$0 and tracks wins and losses. The program is set to pay back 95% of all money entered, so sometimes you win and sometimes you lose.

In lines 35, 45 and 50, use keywords TO or AT. In subroutine 400 a FOR-NEXT loop is used instead of PAUSE to prevent screen flicker. To save valuable memory in 1K, nearly all numbers are expressed in terms of D, E and F (already defined variables).

Here's a neat trick to save memory. If you use a number several times in your program, replace it with a defined variable. For example, if you use 1 several times, enter a line LET A=1. Use A in place of 1 throughout your program, A-A in place of 0, A+A in place of 2. You may be surprised at how much memory you save.

Bob Ferguson, New England Software
Box 691, Hyannis, MA 02601

```

5 LET E=2
10 LET F=3
15 LET M=E-E
20 RAND
25 LET D=AND*E
30 IF D>=F-E THEN PRINT "TRY Y
OUR LUCK"
35 IF D<F-E THEN PRINT "PAY ME
TO WIN"
40 LET D=20
45 PRINT "NOW AT $";M
50 PRINT "PLAY $1 TO $5"
60 INPUT B
70 IF B<F-E OR B>E+F THEN GOTO
D*F
80 PRINT AT E-E,E-E;"
90 PRINT "
100 PRINT "
110 PRINT "
120 PRINT "
130 PRINT "
140 PRINT AT F-E,E;
150 GOSUB D*D
160 LET X=A
170 PRINT TAB E*F;
180 GOSUB D*D
190 LET Y=A
200 PRINT TAB D/E;
210 GOSUB D*D
220 LET Z=A
230 PRINT AT F,E-E;
240 LET M=M-B
250 IF X<>F THEN IF X<>Y OR X<>
Z THEN GOTO D
260 PRINT "YOU WIN $";
270 LET C=E
280 IF Y=F THEN LET C=E+F
290 IF X=Y AND X=Z THEN LET C=D
300 LET M=M+C*B
310 PRINT C*B
320 GOTO D+D
400 LET A=INT (AND*(E*F))
410 FOR Z=E-E TO 65
420 NEXT Z
430 PRINT CHR$ (128+A*E);
440 RETURN

```

SYNTACTIC SUM:39185, 8K

(Line 80-all graphics space,7,7,7, space,etc. Line 90-graphics space, 3 normal spaces, etc. Line 100-all graphics space,6,6,6,space,etc.)

DEFECTIVE 8K ROMS: Brad Lange of Enid, OK, reports that he and friends bought 6 ZX81 kits Dec.81-Apr.82. All 6 kits contained the old 8K ROM with bugs. (Old 8K ROMs give some arithmetic errors and crash after PAUSE commands.) Sinclair said they were unaware of this problem and replaced their ROMs free. Bruce Livett of Montreal, Quebec, finally got his replacement 8K ROM in Feb.82 (ordered Jun.81) and also found it was defective. To check that your 8K ROM is the new, corrected version, type in PRINT PEEK 54. Old ROM gives 132. Improved ROM gives 136. Test from Ian Logan, SYNTAX Dec.81

Paul Pittari reports that he followed the Sinclair schematic for the power converter in the 16K RAM pack with 3 substitutions.

He used a TIP34A transistor to replace the ZTX750, a 1N4007 to replace the BA 221, and an old AM radio antenna to make the auto-transformer. He called later to say the transformer loaded down, 12V dropped to 10V, so he had to rewind it with heavier wire.

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